CLAIMS

1. In a computer including a memory for holding a sequence of instructions to be executed, logic for accessing the instructions in sequence, logic for determining for each instruction the function to be performed and the effective address thereof, and logic for executing each instruction, the improvement comprising:

a) the logic for executing instructions comprising a plurality of individual elements on a common support substrate optimized to perform certain logical sequences employed in executing instructions; and,

b) element selection logic means connected to the logic determining the function to be performed for each instruction for determining the class of each function and for causing the instruction to be executed by those said elements which perform those associated said logical sequences affecting the instruction execution in an optimum manner.

2. The improvement to a computer of claim 1 wherein:

said element selection logic means includes means for accepting dynamic inputs designating changes in ~~the~~ an operating environment of the computer and means for changing the ones of said elements which execute each instruction as a function of said dynamic inputs whereby instruction execution is affected in an optimum manner for the present dynamic conditions.

3. The improvement to a computer of claim 1 wherein:

said elements comprise individual arithmetic and logic units contained on a single central processor unit chip.

4. The improvement to a computer of claim 1 wherein:

said elements comprise individual reduced instruction set computers contained on a single central processor unit chip.

5. The improvement to a computer of claim 1 wherein:

said element selection logic means portion for causing the instruction to be executed by those said elements which perform those associated said logical sequences affecting the instruction execution in an optimum manner includes means for transmitting and switching signals to said elements optically.

6. The improvement to a computer of claim 5 wherein said means for transmitting and switching signals to said elements optically comprises:

a) a holographic optical element including a holographic reflective surface mounted adjacent and parallel to said common support substrate;

b) a plurality of light source means carried by said common support substrate for directing signal-modified light beams towards said holographic reflective surface to be reflected thereby back towards said common support substrate; and,

c) a plurality of light detecting means carried by said common support substrate and operably connected to respective ones of said elements to provide electrical signals thereto for detecting selected ones of said light beams as reflected by said holographic reflective surface and for providing associated electrical signals derived from said reflected light beams to said elements.

7. The improvement to a computer of claim 6 and additionally comprising:

means for individually and selectively switching said light source means on and off to determine which ones of said light detecting means receive said reflected light

beams whereby the sequence of said elements receiving and processing said signals is determined.

8. The improvement to a computer of claim 6 and additionally comprising:

light modulation means disposed between said light source means and said light detecting means for individually and selectively blocking and passing said light beams whereby the sequence of said elements receiving and processing said signals is determined.

9. The improvement to a computer of claim 8 wherein:

said light modulation means is disposed adjacent said reflective surface of said holographic optical element.

10. The improvement to a computer of claim 5 wherein said means for optically transmitting and switching signals to said elements comprises:

a) a reconfigurable holographic optical element device including a holographic reflective surface mounted adjacent and parallel to said common support substrate and including light modulation means disposed adjacent said holographic reflective surface for selectively blocking and passing light beams from reflecting from said holographic reflective surface at individual pixel positions thereof;

b) a plurality of light source means carried by said common support substrate for directing signal-modified light beams towards said holographic reflective surface to be reflected thereby back towards said common support substrate;

c) a plurality of light detecting means carried by said common support substrate and operably connected to respective ones of said elements to provide electrical signals thereto for detecting selected ones of said light beams as reflected by said holographic reflective surface and for providing associated electrical signals derived from said reflected light beams to said elements; and,

d) means for switching said light modulation means on and off at said individual pixel positions thereof to determine which ones of said light detecting means receive said reflected light beams whereby the sequence of said elements receiving and processing said signals is determined.

11. In a computer including a memory for holding a sequence of instructions to be executed, logic for accessing the instructions in sequence, logic for determining for each instruction the function to be performed and the effective address thereof, and logic for executing each instruction, the improved method of operation comprising the steps of:

a) providing a plurality of individual elements on a common support substrate with each element optimized to perform certain logical sequences employed in executing instructions; and for each instruction,

b) determining the function to be performed;

c) determining the class of each function;

d) causing the instruction to be executed by those elements which perform the associated logical sequences affecting the instruction execution in an optimum manner.

12. The method of claim 11 and additionally comprising the steps of:

a) accepting dynamic inputs designating changes in ~~the~~ an operating environment of the computer; and,

b) changing the ones of the elements which execute each instruction as a function of the dynamic inputs whereby instruction execution is affected in an optimum manner for the present dynamic conditions.

13. The method of claim 11 wherein said step of causing the instruction to be executed by those the elements which perform those associated logical sequences affecting

the instruction execution in an optimum manner includes the step of:

optically transmitting and switching signals to the elements.

14. The method of claim ~~13~~ 40 wherein said step of optically transmitting and switching signals to the elements comprises the steps of:

a) disposing a holographic optical element including a holographic reflective surface adjacent and parallel to the common support substrate;

b) disposing a plurality of light sources on the common support substrate for directing signal-modified light beams towards the holographic reflective surface to be reflected thereby back towards the common support substrate;

c) disposing a plurality of light detectors on the common support substrate and operably connecting them to respective ones of the elements to provide electrical signals thereto;

d) selectively switching the light sources on and off to determine which ones of the light detector receive the reflected light beams; and,

e) detecting selected ones of the light beams as reflected by the holographic reflective surface and providing associated electrical signals derived from the reflected light beams whereby the sequence of the elements receiving and processing the signals is determined.

15. The method of claim ~~13~~ 40 wherein said step of transmitting and switching signals to the elements optically comprises the steps of:

a) disposing a reconfigurable holographic optical element including a holographic reflective surface and light modulation means adjacent the holographic reflective surface for selectively blocking and passing light beams from reflecting from the holographic reflective

surface at individual pixel positions thereof adjacent and parallel to the common support substrate;

b) disposing a plurality of light sources on the common support substrate for directing signal-modified light beams towards the holographic reflective surface to be reflected thereby back towards the common support substrate;

c) disposing a plurality of light detectors on the common support substrate and operably connecting them to respective ones of the elements to provide electrical signals thereto;

d) selectively switching the light modulation means on and off at the individual pixel positions thereof to determine which ones of the light detecting means receive the reflected light beams; and,

e) detecting selected ones of the light beams as reflected by the holographic reflective surface and providing associated electrical signals derived from the reflected light beams to the associated elements whereby the sequence of the elements receiving and processing the signals is determined.

16. A dynamically reconfigurable holographic optical element comprising:

a) a planar holographic optical element including a holographic reflective surface;

b) spatial light modulation means disposed adjacent said holographic reflective surface for selectively blocking and passing light beams from reflecting from said holographic reflective surface at individual pixel positions thereof; and,

c) means for switching said spatial light modulation means between conditions of blocking and passing light beams at said individual pixel positions thereof.

17. A dynamically reconfigurable holographic optical element comprising:

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a) a planar holographic optical element having a holographic reflective surface for reflecting light beams directed thereon in a controlled manner; and,

b) a spatial light modulator for selectively blocking and passing light beams at individual pixel positions thereof disposed adjacent said holographic reflective surface, said spatial light modulator including means for switching said spatial light modulator between the blocking and passing of light beams at said individual pixel positions thereof in response to control signals received at an input thereof.

18. The dynamically reconfigurable holographic optical element of claim 17 wherein:

said spatial light modulator is disposed on said holographic reflective surface.

19. A computer comprising:

a) a memory for holding a sequence of instructions to be executed;

b) logic for accessing said instructions in sequence;

c) logic for determining for each said instruction the function to be performed and the effective address thereof;

d) a plurality of individual elements on a common support substrate optimized to perform certain logical sequences employed in executing said instructions; and,

e) element selection logic means connected to said logic determining the function to be performed for each said instruction for determining the class of each function and for causing the instruction to be executed by those said elements which perform those associated said logical sequences affecting the instruction execution in an optimum manner.

17 16
20. The computer of claim ~~19~~ wherein:

said element selection logic means includes means for accepting dynamic inputs designating changes in ~~the~~ an operating environment of the computer and means for changing the ones of said elements which execute each instruction as a function of said dynamic inputs whereby instruction execution is affected in an optimum manner for the present dynamic conditions.

18 16
~~21~~. The computer of claim ~~19~~ wherein:

said elements comprise individual arithmetic and logic units contained on a single central processor unit chip.

19 16
~~22~~. The computer of claim ~~19~~ wherein:

said elements comprise individual reduced instruction set computers contained on a single central processor unit chip.

23. The computer of claim 19 wherein:

said element selection logic means portion for causing the instruction to be executed by those said elements which perform those associated said logical sequences affecting the instruction execution in an optimum manner includes means for transmitting and switching signals to said elements optically.

21 20 41
~~24~~. The computer of claim ~~23~~ wherein said means for transmitting and switching signals to said elements optically comprises:

a) a holographic optical element including a holographic reflective surface mounted adjacent and parallel to said common support substrate;

b) a plurality of light source means carried by said common support substrate for directing signal-modified light beams towards said holographic reflective surface to

be reflected thereby back towards said common support substrate; and,

c) a plurality of light detecting means carried by said common support substrate and operably connected to respective ones of said elements to provide electrical signals thereto for detecting selected ones of said light beams as reflected by said holographic reflective surface and providing associated electrical signals derived from said reflected light beams.

22 21
~~25~~. The computer of claim ~~24~~ and additionally comprising:

means for switching said light source means on and off to determine which ones of said light detecting means receive said reflected light beams whereby the sequence of said elements receiving and processing said signals is determined.

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~~26~~. The computer of claim ~~24~~ and additionally comprising:

light modulation means disposed between said light source means and said light detecting means selectively blocking and passing said light beams whereby the sequence of said elements receiving and processing said signals is determined.

24 23
~~27~~. The computer of claim ~~26~~ wherein:

said light modulation means is disposed adjacent said reflective surface of said holographic optical element.

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~~28~~. The computer of claim ~~23~~ wherein said means for transmitting and switching signals to said elements optically comprises:

a) a reconfigurable holographic optical element including a holographic reflective surface mounted adjacent and parallel to said common support substrate and light modulation means disposed adjacent said holographic

reflective surface for selectively blocking and passing light beams from reflecting from said holographic reflective surface at individual pixel positions thereof;

b) a plurality of light source means carried by said common support substrate for directing signal-modified light beams towards said holographic reflective surface to be reflected thereby back towards said common support substrate;

c) a plurality of light detecting means carried by said common support substrate and operably connected to respective ones of said elements to provide electrical signals thereto for detecting selected ones of said light beams as reflected by said holographic reflective surface and providing associated electrical signals derived from said reflected light beams to said elements; and,

d) means for switching said light modulation means on and off at said individual pixel positions thereof to determine which ones of said light detecting means receive said reflected light beams whereby the sequence of said elements receiving and processing said signals is determined.

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~~29.~~ An optically intraconnected computer comprising:

a) a memory for holding a sequence of instructions to be executed;

b) logic for accessing said instructions in sequence;

c) logic for determining for each said instruction the function to be performed and the effective address thereof;

d) a plurality of individual elements on a common support substrate optimized to perform certain logical sequences employed in executing said instructions; and,

e) element selection logic means connected to said logic determining the function to be performed for each said instruction for determining the class of each function

and for causing the instruction to be executed by those said elements which perform those associated said logical sequences affecting the instruction execution in an optimum manner, said element selection logic means including means for transmitting and switching signals to said elements optically comprising,

P2 e1) a holographic optical element including a holographic reflective surface mounted adjacent and parallel to said common support substrate;

P2 e2) a plurality of light source means carried by said common support substrate for directing signal-modified light beams towards said holographic reflective surface to be reflected thereby back towards said common support substrate; and,

P2 e3) a plurality of light detecting means carried by said common support substrate and operably connected to respective ones of said elements to provide electrical signals thereto for detecting selected ones of said light beams as reflected by said holographic reflective surface and providing associated electrical signals derived from said reflected light beams to said elements.

27 ~~30~~. The optically intraconnected computer of claim 26 ~~29~~ wherein:

P1 said element selection logic means additionally includes means for accepting dynamic inputs designating changes in the operating environment of the optically intraconnected computer and means for changing the ones of said elements which execute each instruction whereby instruction execution is affected in an optimum manner for the present dynamic conditions.

28 ~~31~~. The optically intraconnected computer of claim 26 ~~29~~ wherein:

said elements comprise individual arithmetic and logic units contained on a single central processor unit chip.

~~32~~ 29. The optically intraconnected computer of claim ~~29~~ 26 wherein:

said elements comprise individual reduced instruction set computers contained on a single central processor unit chip.

~~33~~ 30. The optically intraconnected computer of claim ~~29~~ 26 and additionally comprising:

means for switching said light source means on and off to determine which ones of said light detecting means received said reflected light beams whereby the sequence of said elements receiving and processing said signals is determined.

~~34~~ 31. The optically intraconnected computer of claim ~~29~~ 26 and additionally comprising:

light modulation means disposed between said light source means and said light detecting means for selectively blocking and passing said light beams whereby the sequence of said elements receiving and processing said signals is determined.

~~35~~ 32. The optically intraconnected computer of claim ~~34~~ 31 wherein:

said light modulation means is disposed adjacent said reflective surface of said holographic optical element.

~~36~~ 33. The optically intraconnected computer of claim ~~29~~ 26 wherein:

a) said holographic optical element of said means for transmitting and switching signals to said elements optically comprises a reconfigurable holographic optical element including a holographic reflective surface

mounted adjacent and parallel to said common support substrate and light modulation means disposed adjacent said holographic reflective surface for selectively blocking and passing light beams from reflecting from said holographic reflective surface at individual pixel positions thereof; and additionally comprising,

P1

b) means for switching said light modulation means on and off at said individual pixel positions thereof to determine which ones of said light detecting means receive said reflected light beams whereby the sequence of said elements receiving and processing said signals is determined.

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